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ABSTRACT

Individual differences in fourth grade students' abilities to profit from experimenter-provided picture adjunct aids on prose recall tasks were examined. It was hypothesized that poor paired associate learners would benefit from picture adjunct aids to a greater extent than good paired associate learners. A secondary aim was to assess the effects of requiring children to act on pictures. Data were gathered from two experiment phases: trials of paired associate tasks using noun pairs presented as words or line drawings to classify learner types, and three story reading and recall tasks in "No Picture" or "Picture" adjunct conditions. A fourth story involved a multiple-choice picture task and oral free recall test. Overall mean performance for picture and word pair learners were classified as high picture-high word (HH), high picture-low word (HL), low picture-high word (LH), and low picture-low word (LL). Although the Learner X Picture interaction was not significant in every analysis, the significant interactions that were found and the general pattern of results support the hypothesis that picture adjunct aids help LLs more than HHs on a constructed response task. Factors of "Reading Ability" and "Picture" were also examined. (CM)

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Individual Differences in Children's Ability to Profit from Picture Adjunct Aids

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Individual differences among four types of learners in their memory performance under imagery or no imagery instructions have been examined by Levin, Divine-Hawkins, Kerst, and Guttmann (1974). Their fourth-grade subjects were classified on the basis of their performance on a paired-associated memory task which involved pairs of words and pairs of pictures as stimuli and responses. Each child's paired-associate scores for pictures and for words were compared to the mean performance of all subjects on pictures and words, respectively. Based on these comparisons, children were classified as high picture-high word, or "HH," because they were above the mean performance for both picture and word pairs, high picture-low word (HL), low picture-high word (LH), or low picture-low word (LL). Half of the children in each learner classification group were instructed to form mental images while reading stories in the second phase of the experiment; the other children were given standard recall instructions. Following the reading task, all children took a short answer test for facts in the story. For children who were good picture learners on

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the paired associate task (i.e., HH and HL), those with imagery instructions performed better on the short answer test than those who received standard instructions. For children classified as LL, imagery instructions led to decreased test performance.

Hughes and Hall (1981) used the procedure of Levin et al. (1974) to classify college students into the same categories as those used in the Levin et al. study. For half of the subjects in each learner category, adjunct pictures accompanied the prose reading passage; the other subjects read the same story without any adjunct pictures. After reading the story, all subjects took a short-answer test on the factual content of the story. The LL subjects who received adjunct pictures performed significantly better than did LL subjects who did not receive adjunct pictures. The HH and HL subjects performed equally well in the picture and no-picture conditions. As had been the case in the Levin et al (1974) study, too few subjects were classified as LH to include these subjects in statistical analyses.

Taken together, the Levin et al. and Hughes and Hall studies may suggest that good paired-associate learners provide their own mediators and are not as likely to profit from picture adjunct aids as are poor paired associate learners; poor paired-associate learners may need picture aids as an external source of the type of mediation that facilitates comprehension and memory--the type of mediation that good learners provide on their own or can generate when instructed to do so.

Although picture adjunct aids may facilitate some learning, especially for poor paired-associate learners, it is possible that learners who are not helped by pictures have failed to notice the pictures, or have failed to examine the pictures closely while attempting to relate the picture to the textual information. Forcing subjects to process pictorial aids more thoroughly generally results in better performance for subjects in a picture aid condition (e.g., Lesgold, DeGood, & Levin, 1977; Lesgold, Levin, Shimron, & Guttmann, 1975; Levin, Bender, & Lesgold, 1976). Thus, picture aids appear to facilitate comprehension and memory performance for written prose, but some subjects may need to be induced to notice and actively encode the pictures for a facilitating effect to be observed.

The present experiment examined individual differences in fourth graders' ability to profit from experimenter-provided picture adjunct aids on prose recall tasks. This experiment was expected to demonstrate that the differences between the Levin et al. (1974) study and the Hughes and Hall study (1981) were not due to differences in the subject populations; that is, fourth graders vs. college students, but were, instead, due to individual differences among subjects in the ability to profit from subject-generated imagery versus experimenter-provided pictures. It was hypothesized that poor paired-associated learners would benefit from picture adjunct aids to a greater extent than good paired associate learners (i.e., the same pattern found with

college subjects in the Hughes and Hall study). A secondary aim of the present experiment was to assess the effects of requiring children to act on the pictures. Such activity was expected to increase the relative facilitation of pictures for poor paired-associate learners compared to good paired-associate learners, because the poor paired-associate learners would be less likely to spontaneously use standard picture aids mnemonically.

Eighty-three fourth graders performed 2 trials of the paired-associate task that was used to classify learner types. Stimuli for this task were presented by slide projector and consisted of 32 noun pairs depicted either as words or as line drawings. Each child received 8 word pairs and 8 picture pairs in each of the two 16-pair lists. Across subjects, each noun pair was represented equally often as pictures and as words.

Children were tested in groups of 4 to 8. They were given standard paired associate instructions and shown sample word and picture pairs. List 1 was presented twice through at an 8-sec. rate. The experimenter then read aloud the first word of each pair, in a new random order, for children to write down the second member of each pair. The same procedure was followed for List 2, which was presented immediately after List 1 recall.

In Phase 2, the reading and recall tasks, seventy-seven of the children who participated in Phase 1 were subjects.

Four short stories, one of which is shown in the handout, were used for the reading passages. Each story described a different fictional animal. Of the facts in each story, 3 described physical features of the animal and were always pictured along with the story for those children who received picture adjunct aids. Some of the remaining facts were randomly chosen to be depicted in 3 line drawings and the other facts were not depicted in drawings. Thus, for children who received picture aids, there were 4 drawings to the right of the written text which depicted several of the facts in the story; children who did not receive picture aids received the same stories without any pictures.

Children were tested individually in Phase 2. This testing began one week after the completion of Phase 1, and occurred over a 3-week period. The first story was given to the child and he or she was asked to read it to the experimenter. Then, the child was asked to read the story silently, study it, and try to remember it. Children in the picture adjunct aid condition were also told that the pictures are there to help them understand and remember the story. After a child had read and studied for 3 minutes, and then worked a maze as a ~~final~~ FILLER task, the child orally recalled the story. The same procedure was followed with the second and third stories.

The fourth story was accompanied by four pairs of pictures, drawn ~~to the right of the story~~ ON A SEPARATE PAGE (see handout). Only one of each pair of

pictures correctly illustrated a part in the passage. Children in the picture condition were asked to circle the one picture in each row that correctly illustrated the story. An oral free recall test was given for the fourth story, following the maze problems. Then a constructed response test was given to test memory for all four of the stories.

Learner classifications were determined by the method used by Levin et al. (1974). Each child's combined Trial 1 and Trial 2 score for pictures and for words on the paired-associate task was compared to the overall mean performance for picture and word pairs, respectively, and learners were classified as HH, HL, LH, and LL.

Of the 77 children who participated in Phase 2 of the experiment, there were 25 classified as HH, 15 HLs, 12 LHs, and 25 LLs. Because children in each learner classification were in either the Picture or No-Picture condition, the number of children per cell in the experimental design was deemed to be too low for the HL and LH groups; therefore, these learner classifications were not used in any statistical analyses.

An analysis of variance was performed on the free recall data for the first three stories combined, and a similar analysis was performed for the fourth story. The first three stories were combined because the manipulations for these stories were the same, while the fourth story involved the multiple-choice picture task. In the analysis for the first three stories, HHs performed significantly better

than LLs. The main effects of Picture and the Learner X Picture interactions were not significant.

Additional analyses of variance were performed separately for Pictured and Non-Pictured facts; that is, facts which were pictured for Ss in the picture condition vs. facts not pictured even in the picture condition, but the result of most interest, the Learner X Picture interactions, were not significant for either elaborated or non-elaborated facts for either the first three stories or the fourth story.

Analyses of variance were performed on total scores on the constructed response task. The analysis for the first three stories revealed no significant main effects, but a significant Learner X Picture interaction (see Handout Fig. 1). The interaction was mainly due to the significantly higher performance of HHs compared to LLs in the No-Picture condition, while there was no significant difference between learner types in the Picture condition.

The analysis of variance for the fourth story indicated a significant main effect of Learner, with HHs again better than LLs. Neither the Picture main effect nor the Learner X Picture interaction was significant, although it may be seen in Figure 1 that the Learner X Picture pattern was similar to that found for the first three stories.

Further analyses of variance were performed separately for Pictured and Non-Pictured facts. As can be seen in Figure 2, the pattern

of results for the Pictured facts for the first three stories and for the fourth story are similar; however, no significant effects were found in the analysis involving the first three stories. The analysis for Pictured facts in the fourth story, however, revealed a significant main effect of Picture, and a significant Learner X Picture interaction. Children classified as HH were superior to LLs in the No-Picture condition, while there was not a significant difference between learner types in the Picture condition (see Fig. 2). In addition, LLs performed significantly better in the picture condition than in the No-Picture condition. Similar analyses were performed for the Non-Pictured facts. For the first three stories, there were no significant main effects, but there was a significant Learner X Picture interaction. Again, the interaction is due to the significantly better performance of HHs compared to LLs in the No-Picture condition, but not in the Picture condition. For the Non-Pictured facts in the fourth story, there was a significant main effect of Learner, with HHs better than LLs. Neither the Picture main effect nor the Learner X Picture interaction was significant.

Although the Learner X Picture interaction was not significant in <u>every</u> analysis, the significant interactions that <u>were</u> found and the consistent general pattern of results support the hypothesis that picture adjunct aids help LLs more than they help HHs on a constructed response task. The one instance in which this pattern does not

appear is for the non-elaborated facts in the fourth story. It could be that forced processing of elaborated facts diverts too much attention and processing time away from non-elaborated facts, such that neither learner type is helped to remember the non-elaborated facts by the presence of pictures which illustrate only the elaborated facts.

SRA reading scores were obtained for 75 of the 77 children who participated in Phase 2 of the experiment. Children's total reading scores were used to divide them into one group with scores above the national average and the other group below the national average. This procedure resulted in 51 children classified as good readers (28 in the Picture condition; 23 in the No-Picture condition) and 24 children classified as poor readers (9 in the Picture condition; 15 in the No-Picture condition).

Four analyses of variance with the factors of Reading Ability and Picture were performed for free recall and constructed response data. As before, separate analyses were performed for the first three stories and for the fourth story. In every analysis, it was found that good readers performed significantly better than poor readers. More important, however, was the failure to find <u>any</u> significant Reading Ability X Picture interactions. Thus, although reading scores relate to recall, they do not help determine who will and who will not profit from picture adjunct aids.

Because learner classifications based on the paired-associate task were analyzed only for the 50 children classified as HH or LL, while reading ability classifications resulted in analyses involving 75 children, it could be argued that the HHs really represented the high end of the reading ability distribution, while the LLs represented the low end. Of the 24 HHs for whom reading scores were available, 20, indeed, were classified as good readers, while only 4 were classified as poor readers. Of the 25 LL children, 11 were classified as poor readers, but 14 were classified as good readers. To determine whether the classification systems resulted in the pattern described above (i.e., HH = good readers, LL = poor readers), a phi coefficient was calculated and found to be not significant. Thus, although it does appear that HHs usually are good readers, LLs are not necessarily poor readers.

The present experiment demonstrates that children who are poor paired-associate learners (LLs) are more likely than good paired-associate learners (HHs) to profit from picture adjunct aids on a prose memory task. This pattern of results consistently was found for a constructed response task (short answer questions) on the prose material, but was not found on the free recall task. It is possible that the free recall test was given too soon after children studied each story for pictures to be helpful or necessary to any children as retrieval aids. In addition, the constructed response task is

probably more similar than a free recall task to the tests usually given to fourth graders, suggesting that the constructed response results have greater ecological validity.

The finding that poor paired-associate learners are helped more than good paired-associate learners by picture aids may seem to contradict the results of Levin et al. (1974), because they found good paired-associate learners to profit more than poor paired-associate learners from instructions to form mental images while reading a prose passage prior to a constructed response test. Indeed, Levin et al. suggested that LL subjects should not be expected to profit from adjunct pictures, because "low-picture, low-word subjects . . . have difficulty learning from pictures as well as from words" (p. 300). We suggest that LL children are not likely to be helped by instructions to generate their own mental images because they are poor in the systematic, planful application of such mediators to reading material. When children do not have to generate their own mediational aids, but these aids, such as pictures, are provided by an experimenter, much less strategic ability is required for LL children to be able to use the pictures to aid comprehension and memory. The HH children probably are good at generating their own mediators; they may have been classified as HHs mainly <u>because</u> they were good at generating mediators on the paired-associate task used to classify them. These HHs would not need Experimenter-supplied picture aids as much as would LLs. Thus, HHs would be unlikely to perform

significantly better with picture adjunct aids than without them, while LLs would perform poorly on memory tasks unless someone provided the mediators they seem unlikely or unable to generate for themselves.

Requiring children to process adjunct pictures in various ways may influence the level and pattern of prose memory performance. In the fourth story manipulation of the present experiment, children were required to choose, from pairs of pictures, those which correctly illustrated the prose passage. Although children in this condition remembered more pictured facts than did children who received no adjunct pictures, memory for Non-Pictured facts was usually lower for children who received pictures than for those who received no pictures. Because only three minutes were allowed for children to perform both the picture multiple-choice task and to study the story prior to free recall, children in the picture condition may have focused too much time and attention on the elaborated items, thus impairing their memory for nonelaborated items. In a more natural setting, children would not be likely to be so limited in processing time, and more study time should help them pay adequate attention to the nonelaborated items. Therefore, before arguing that processing tasks for picture adjunct aids be avoided, or that picture adjunct aids must illustrate <u>every</u> important fact, additional studies are needed. These studies should examine various processing

tasks and the effects of various ratios of elaborated to nonelaborated facts, and should allow sufficient time for children to process both elaborated and nonelaborated facts fully.

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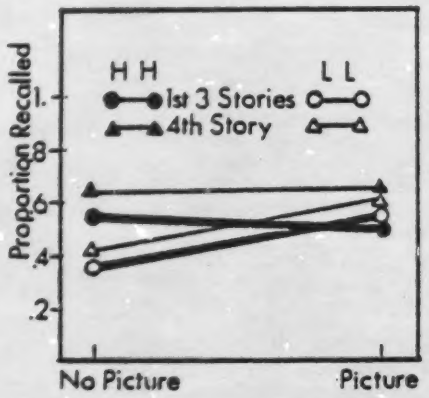

Figure 1. Proportion recalled on constructed response task for HH and LL children in No-Picture and Picture conditions. Significant interactions are indicated by bold lines.

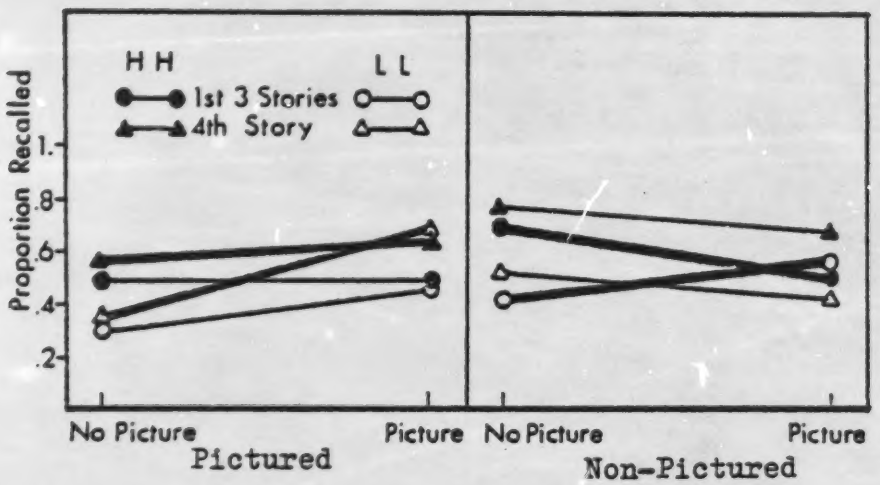

Figure 2. Proportion recalled for pictured and for non-pictured facts separately on the constructed response task for HH and LL children in No-Picture and Picture conditions. Significant interactions are indicated by bold lines.